REMARKS

Reconsideration and withdrawal of the requirement for election of species and rejections of the application respectfully requested in view of the amendments, remarks and enclosures herewith, which place the application in condition for allowance.

I. STATUS OF CLAIMS AND FORMAL MATTERS

Claims 84-220 are now pending in this application, with new claims 84-220 presented herewith, and representing the subject matter of previous claims 1-83, as well as embodiments set forth in the specification. All of the species of the previous claims remain pending, so that the Examiner may allow them, and the generic claims, as discussed in the Office Action,[1] with claims 210-220 introduced as dependent method claims which are subject to examination with the product claims upon which the method claims depend. No new matter is added.

It is submitted that the claims herewith and as previously pending are and were patentably distinct from the references cited by the Examiner, and that these claims are and were in full compliance with the requirements of 35 U.S.C. §112. The new claims herein are not made for the purpose of patentability within the meaning of 35 U.S.C. §§ 101, 102, 103 or 112; but rather the new claims are presented simply for clarification and to round out the scope of protection to which Applicants are entitled. Furthermore, it is explicitly stated that the herewith new claims should not give rise to any estoppel, as the herewith new claims are not believed to represent a narrowing amendment with respect to the previously pending claims.

Drawings

The Examiner is thanked for indicating that the drawings are acceptable for examination purposes.

Specification

The disclosure was objected to because the top margin of all pages of the specification, specifically pages 71-82, did not comply with 37 CFR 1.52(a). Substitute pages 70-81, containing the claims and corresponding to pages 70-82 of the application as filed, are attached.

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[1] As to the species election requirement, the Examiner is also respectfully directed by analogy to MPEP 803.02 which addresses restriction practice for *Markush* groups and directs that if the members of the *Markush* group are sufficiently few in number, the Examiner must examine all claims on the merits, even though they are directed to independent and distinct inventions. It is respectfully submitted that the species presented in the claims are sufficiently few in number that all can be searched and examined together in this application.

No new matter is added. Reconsideration and withdrawal of the objection to the specification are requested.

II. THE REJECTIONS UNDER 35 U.S.C. §112, 2ND PARAGRAPH, ARE OVERCOME

Claims1-12, 18-21, 44-55 and 60-63 were rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite.

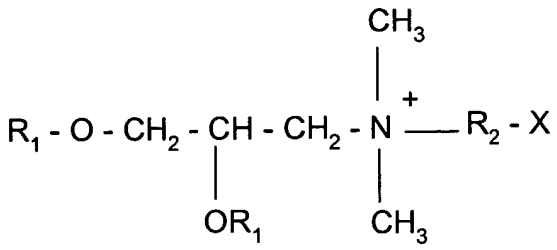
As new claims are presented herewith, the rejection is moot. Nonetheless, it is also stated that great care was taken in drafting the new claims to avoid in the new claims any informalities that gave rise to this rejection.

Reconsideration and withdrawal of the rejection under 35 U.S.C. §112, second paragraph, are respectfully requested.

III. THE REJECTIONS UNDER 35 U.S.C. §103 ARE OVERCOME

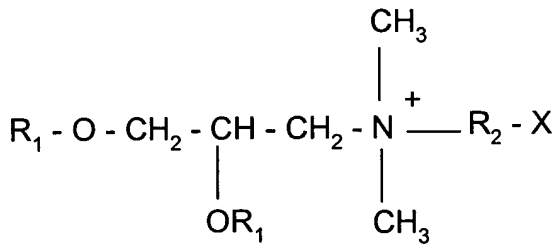
Claims 1-8 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Xiang *et al.* in view of Harris *et al.* Claims 1-8, 18 and 60-63 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Taylor *et al.* in view of Harris *et al.*, Xiang *et al.*, and Baker *et al.* Claims 1-9, 11, 12, 18-20, 44-47, 52-55 and 60-63 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Taylor *et al.* in view of Harris *et al.*, Xiang *et al.*, and Baker *et al.* and in further view of Li *et al.* Claims 1-8, 10, 18-20, 58-51 and 60-63 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Taylor *et al.* in view of Harris *et al.*, Xiang *et al.*, Baker *et al.*, and Choi *et al.* And claims 1-12, 18-21, 44-55, and 60-63 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Taylor *et al.* in view of Harris *et al.*, Xiang *et al.*, Baker *et al.*, Choi *et al.*, and Klein. These rejections are addressed collectively and are respectfully traversed.

The present invention provides a DNA vaccine against a bovine pathogen comprising at least one plasmid that contains and expresses in a bovine host cell a nucleotide sequence encoding an immunogen of the bovine pathogen, and a cationic lipid containing a quaternary ammonium salt, of the formula



in which R_1 is a saturated or unsaturated linear aliphatic radical having 12 to 18 carbon atoms, R_2 is an aliphatic radical containing 2 or 3 carbon atoms, and X a hydroxyl or amine group.

The present invention also provides a DNA vaccine against a porcine pathogen comprising at least one plasmid that contains and expresses in a porcine host cell a nucleotide sequence encoding an immunogen of the porcine pathogen, and a cationic lipid containing a quaternary ammonium salt, of the formula



in which R_1 is a saturated or unsaturated linear aliphatic radical having 12 to 18 carbon atoms, R_2 is an aliphatic radical containing 2 or 3 carbon atoms, and X a hydroxyl or amine group.

The lipid can be DMRIE and the vaccine can further comprise DOPE. The vaccine can also further comprise bovine or porcine GM-CSF, or an expression vector that contains and expresses in a porcine host cell a nucleotide sequence encoding porcine GM-CSF, or an expression vector that contains and expresses in a bovine host cell a nucleotide sequence encoding porcine GM-CSF, wherein this additional expression vector can be a plasmid. The nucleotide sequence encoding the immunogen can have deleted therefrom a portion encoding a transmembrane domain, and the plasmid can further contain and express in a a nucleotide sequence encoding a heterologous tPA signal sequence, such as a human tPA signal sequence. Even further, the plasmid can further contain a stabilizing intron, such as intron II of a rabbit beta-globin gene.

In the elected species, the bovine pathogen is bovine respiratory syncitial virus (BRSV). The immunogen can be BRSV F or BRSV G. For instance, the immunogen can be BRSV F or

G, modified by substitution of the BRSV F signal sequence with a human tPA signal sequence, and/or by deletion of the transmembrane domain.

Indeed, the vaccine can comprise: (1) a first plasmid that contains and expresses in a bovine host cell a nucleotide sequence encoding bovine respiratory syncitial virus (BRSV) F, modified by substitution of the BRSV F signal sequence with a human tPA signal sequence and deletion of the transmembrane domain and contiguous C-terminal portion; and (2) a second plasmid that contains and expresses in a bovine host cell a nucleotide sequence encoding BRSV G, modified by substitution of the BRSV G signal sequence with a human tPA signal sequence and deletion of the transmembrane domain and contiguous C-terminal portion; and (3) DOPE, with the lipid being DMRIE, whereby the vaccine comprises the aforementioned two plasmids and DMRIE-DOPE.

Similar embodiments are presented in the claims as to the other species.

None of the cited documents teaches or suggests a DNA vaccine that comprises, *inter alia*, a plasmid that expresses DNA encoding an immunogen of a pathogen affecting farm animals, particularly porcines or bovines.

The Office Action the Examiner asserts that mice are farm animals. The undersigned, upon receiving the Office Action endeavored to interview the case, and thanks the Examiner and his Primary Examiner, Jeff Fredman, for their efforts, even though an interview never resulted. During the communications in the attempts to schedule an interview, the undersigned expressed the view that mice are not considered "farm animals" and received a voice message calling attention to www.mousefarm.com.

While mice may be raised for various purposes, e.g., as food for other animals such as snakes, or for experimental purposes, mice are not considered farm animals; on a farm, mice are considered pests, vermin. For instance, the Examiner is invited to consider the "farm animals" illustrated at Enchanted Learning's website and the KidsFarm website, respectively, http://www.enchantedlearning.com/coloring/farm.shtml and http://www.kidsfarm.com/farm.htm – none of those farm animals appear to be mice. The Examiner is also invited to consider the animals The Humane Society of the United States considers to be farm animals at their website http://www.hsus.org/ace/15419 – none of which appear to be mice. Indeed, the Humane Society and The Midwest Farm Animal Rescue appear to have a programs for farm animals, to which

one can make a donation, or from which one may adopt a farm animal, *see, e.g.,* http://www.mfar.org/. The undersigned has not located any mice to so adopt; nor has the undersigned learned of any rescues of mice. The Examiner is further invited to consider the animals of concern to The Farm Animal Welfare Council of the United Kingdom http://www.fawc.org.uk/index.htm – whose five freedoms for animals do not seem to include how mice are treated on a typical farm; namely killed as vermin or pests.

In short, it is very respectfully submitted that the Office Action stretches the meaning of "farm animals" to beyond its normal, accepted definition; mice, while they may be raised as food for other animals or for experimental purposes, are NOT considered "farm animals" in the normal sense in which one uses the term "farm animals." Nonetheless, to assist in advancing the prosecution, the claims are directed to the "particular" recitation of original claim 1, namely, as discussed above, to DNA vaccines for "bovines or porcines" (e.g., cows or pigs), as it is believed that so directing the claims is NOT a narrowing of scope, and it allows for agreement to be readily achieved, especially on the concept that bovines and porcines are NOT rodents (or, for example, cows and pigs are NOT mice).

Further still, not only are premises for the art rejections respectfully challenged, the Examiner is respectfully reminded that for a Section 103 rejection, there must be some prior art teaching which would have provided the necessary incentive or motivation for modifying the reference teachings to arrive at the claimed invention. *In re Laskowski*, 12 U.S.P.Q. 2d 1397, 1399 (Fed. Cir. 1989); *In re Obukowitz*, 27 U.S.P.Q. 2d 1063 (BOPAI 1993). Further, "obvious to try" is not the standard under 35 U.S.C. §103. *In re Fine,* 5 U.S.P.Q. 2d 1596, 1599 (Fed. Cir. 1988). And, as stated by the Court in *In re Fritch*, 23 U.S.P.Q. 2d 1780, 1783-1784 (Fed. Cir. 1992): "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggests the desirability of the modification." Also, the Examiner is additionally respectfully reminded that for the Section 103 rejection to be proper, **both the suggestion of the claimed invention and the expectation of success must be founded in the prior art, and not Applicants' disclosure**. *In re Dow*, 5 U.S.P.Q.2d 1529, 1531 (Fed. Cir. 1988).

Furthermore, the Examiner is also respectfully reminded that MPEP 2143.01 mandates that for a Section 103 rejection, there must be some suggestion or motivation to modify reference

teachings, and, that MPEP 2143.02 further mandates that for a Section 103 rejection, there must be a reasonable expectation of success.

Thus, both the case law and the MPEP require that for a Section 103 rejection, there must be some teachings, suggestion, motivation, or incentive to modify reference teachings to arrive at the claimed invention, and there must be some reasonable expectation of success of the claimed invention.

Against this background, Xiang *et al.* relates to mice, which, as discussed above, are not farm animals. That is, Xiang does not contain any teachings or suggestions as to DNA vaccines for farm animals, particularly bovines or porcines.

Submitted herewith is a copy of Schultz *et al.* (Intervirology, 2000, 43:197-217). Schultz provides a review of antiviral DNA vaccine research from 1998-2000. One conclusion drawn by Schultz *et al.* exemplifies why vaccine results may not be extrapolated between species, and particularly why teachings or suggestions as to mice cannot be extrapolated to larger animals such as bovines or porcines:

> Several DNA vaccines have proven efficacious in small animal models, especially mouse models. In larger species, DNA vaccines were less effective.

Schultz at 203.

Thus, contrary to the assertions in the Office Action, one cannot extrapolate vaccine data from smaller animals such as mice to larger animals such as bovines or porcines. Therefore, Xiang *et al.*, either individually or in any combination, cannot be said to teach or suggest the instant invention. Further, according to the conclusions of Schultz *et al.*, there is no reasonable expectation that the jump from mice to large farm animals, particularly bovines or porcines, would be successful. Harris *et al.* fails to remedy the deficiencies of Xiang as Harris only provides information only on cationic amphiphiles.

Accordingly, Xiang and Harris fail to teach or suggest the instant invention, and reconsideration and withdrawal of the Section 103 rejection based on Xiang and Harris are respectfully requested.

Taylor *et al.* does NOT teach or suggest anything pertaining to a DNA plasmid vaccine as recited in the instant claims; but rather, relates to a vaccinia virus vaccine. There is NOTHING in the art, or any of the cited documents, that allows one to extrapolate teachings and suggestions

as to a vaccinia virus vaccine – a poxvirus vaccine – to a DNA plasmid vaccine. The characterization of Taylor in the Office Action, it is respectfully submitted, is incorrect" Taylor does NOT "teach[] a DNA vaccine ..." A recombinant vaccinia virus, as in Taylor, is an enveloped poxvirus, NOT a DNA plasmid, as called for by the instant claims. The skilled artisan does not equate a recombinant vaccinia virus vaccine with a DNA plasmid vaccine, nor does the skilled artisan extrapolate from teachings and suggestions as to recombinant vaccinia virus vaccines to DNA plasmid vaccines. Therefore, Taylor, either individually or in any combination, fails to teach or suggest the instant invention.

Harris, as discussed above, only provides information only on cationic amphiphiles and does not remedy the deficiencies of Taylor or of Xiang.

Also discussed above, the results of Xiang *et al.* in mice cannot be extrapolated to farm animals, particularly bovines or porcines, such that Xiang does not remedy the deficiencies of Taylor and Harris.

Baker *et al.* deals only with DNA encoding bovine GM-CSF. Nowhere in Baker is there any teaching or suggestion that GM-CSF protein could or should be administered as a component of a DNA vaccine or be co-expressed in a DNA vaccine, let alone a vaccine comprising a DNA plasmid and a cationic lipid, as in the instant claims. Thus, Baker fails to remedy the deficiencies of Taylor, Xiang, and Harris.

Therefore, the combination of Taylor, Harris, Xiang and Baker does not result in the claimed invention, as this combination does not teach or suggest the instant invention, nor does it offer any expectation that the present invention would be successful. Further, it is respectfully submitted, the combination fails to even raise to the standard of "obvious to try" (which, as mentioned earlier, is NOT the standard for making a Section 103 rejection). Accordingly, Taylor, Harris, Xiang and Baker, either individually or in any combination, fails to teach or suggest the instant invention. Therefore, reconsideration and withdrawal of the Section 103 rejection based on this combination are respectfully requested.

As discussed above, the combination of Taylor *et al.*, Harris *et al.*, Xiang *et al.*, and Baker *et al.* does not teach or suggest the instant invention. The combination of these documents does not provide or even suggest an efficacious DNA plasmid vaccine expressing DNA encoding

an immunogen of a pathogen affecting farm animals, particularly bovines or porcines, and also comprising a cationic lipid. Li *et al.* does not cure this defect.

Li involves plasmids expressing RSV F that were tested in mice. Li is no better than Xiang; and, in view of Schultz, submitted herewith, fails to provide teachings or suggestions as to the instant invention or supply the deficiencies of Taylor *et al.*, Harris *et al.*, Xiang *et al.*, and Baker *et al.* Accordingly, Taylor *et al.*, Harris *et al.*, Xiang *et al.*, Baker *et al.* and Li *et al.*, either individually or in any combination, fail to teach or suggest the instant invention.

Likewise, that Choi may relate to human tPA fails to remedy the deficiencies of Taylor *et al.*, Harris *et al.*, Xiang *et al.*, Baker *et al.* and Li *et al.* For instance, Choi also only involved tests with mice, such that Choi is no better than Xiang; and, in view of Schultz submitted herewith, fails to provide teachings or suggestions as to the instant invention. Further still, Choi does not teach or suggest a human tPA/BRSV F or G fusion expressed *in vivo* in a bovine host by a DNA plasmid vaccine containing a cationic lipid, or the benefits thereof. Accordingly, Taylor *et al.*, Harris *et al.*, Xiang *et al.*, Baker *et al.* Li *et al.*, and Choi *et al.* either individually or in any combination, fails to teach or suggest the instant invention.

Klein relates to a two-step immunization procedure involving recombinant poxviruses – recombinant NYVAC or ALVAC, and like Taylor, provides no teachings or suggestions as to DNA plasmid vaccines. Again, teachings and suggestions as to poxviruses are teachings and suggestions as to an enveloped poxvirus, NOT a DNA plasmid, as called for by the instant claims. The skilled artisan does not equate a recombinant ALVAC or NYVAC poxvirus vaccine with a DNA plasmid vaccine, nor does the skilled artisan extrapolate from teachings and suggestions as to recombinant poxvirus virus vaccines to DNA plasmid vaccines. Thus, Klein fails to teach or suggest the instant invention or remedy the deficiencies of Taylor *et al.*, Harris *et al.*, Xiang *et al.*, Baker *et al.* Li *et al.*, and Choi *et al.*

If anything, Klein helps to show the deficiencies of Li. In particular, Klein admits that "previous attempts to produce a safe and effective RSV vaccine were unsuccessful. ... **In fact, immunization of seronegative infants with the FI-RSV vaccine resulted in the exacerbation of RSV disease (immunopotentiation) in some vaccinees following exposure to wild type virus. ... efficacy of the RSV subunit vaccines tested to date have been inconsistent**

(emphasis added)." Thus, if anything, Klein also shows that one cannot extrapolate from the mice data in Li, as previously herein asserted based upon Schultz submitted herewith.

Therefore, reconsideration and withdrawal of the Section 103 rejections based upon the combinations of: Taylor *et al.* in view of Harris *et al.*, Xiang *et al.*, and Baker *et al.* in further view of Li *et al.*, Taylor *et al.* in view of Harris *et al.*, Xiang *et al.*, and Baker *et al.* in further view of Choi *et al.*, and Taylor *et al.* in view of Harris *et al.*, Xiang *et al.*, and Baker *et al.* in further view of Li *et al.*, Choi *et al.*, and Klein, are respectfully requested.

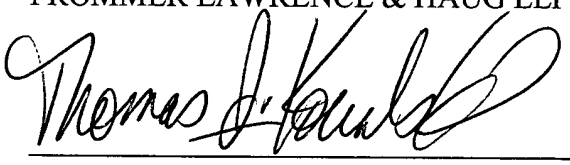
REQUEST FOR INTERVIEW

If any issue remains as an impediment to allowance, an interview, with supervisory review, is respectfully requested prior to issuance of any paper other than a Notice of Allowance. The Examiner is additionally respectfully requested to telephonically contact the undersigned to arrange a mutually convenient time and manner for the interview. The Examiner is also invited to telephonically contact the undersigned if there are any minor, formal issues that need resolving prior to issuance of a Notice of Allowance, with a view towards resolving such minor, formal issues via telephonic interview.

CONCLUSION

In view of these amendments, remarks and article and attachments submitted herewith, the application is in condition for allowance. Early and favorable reconsideration of the application, reconsideration and withdrawal of the rejections, and prompt issuance of a Notice of Allowance are earnestly solicited.

Respectfully submitted,
FROMMER LAWRENCE & HAUG LLP

By: 

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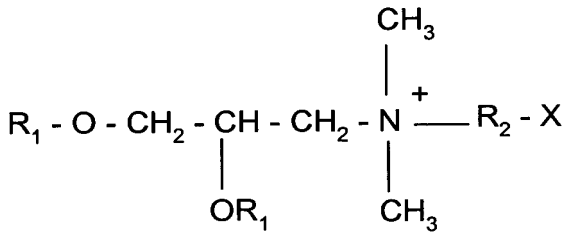
Claims

1. DNA vaccine against a pathogen affecting farm animals, in particular bovines or porcines, comprising a plasmid containing a nucleotide sequence encoding an immunogen of a pathogen of the animal species considered, under conditions allowing the *in vivo* expression of this sequence, and a cationic lipid containing a quaternary ammonium salt, of formula



in which R_1 is a saturated or unsaturated linear aliphatic radical having 12 to 18 carbon atoms, R_2 is another aliphatic radical containing 2 or 3 carbon atoms, and X a hydroxyl or amine group, this lipid being preferably DMRIE.

2. Vaccine according to Claim 1, wherein it also comprises DOPE.

3. Vaccine according to Claim 1, wherein it comprises, in addition, a GM-CSF protein of the animal species considered.

4. Vaccine according to Claim 2, wherein it comprises, in addition, a GM-CSF protein of the animal species considered.

5. Vaccine according to Claim 1, wherein it comprises, in addition, an expression vector containing the gene encoding the GM-CSF protein of the animal species considered, under conditions allowing the *in vivo* expression of this sequence.

6. Vaccine according to Claim 2, wherein it comprises, in addition, an expression vector containing the gene encoding

the GM-CSF protein of the animal species considered, under conditions allowing the *in vivo* expression of this sequence.

7. Vaccine according to Claim 5, wherein the expression vector is a plasmid.

8. Vaccine according to Claim 6, wherein the expression vector is a plasmid.

9. Vaccine according to Claim 1, wherein the nucleotide sequence encoding a pathogen immunogen is the sequence of a gene from which the part encoding the transmembrane domain has been deleted.

10. Vaccine according to Claims 1, wherein the plasmid containing the nucleotide sequence encoding a pathogen immunogen also contains a nucleotide sequence encoding a heterologous signal sequence, preferably a tPA.

11. Vaccine according to Claim 1, wherein the plasmid containing the nucleotide sequence encoding a pathogen immunogen also contains a stabilizing intron.

12. Vaccine according to Claim 11, wherein the intron is intron II of the rabbit beta-globin gene.

13. Vaccine according to Claim 1, wherein it comprises a nucleotide sequence of BHV-1.

14. Vaccine according to Claim 13, wherein it comprises the sequence of the gB gene optimized by a signal sequence, in particular that of the tPA signal of human origin, in place of the sequence of the signal peptide of the glycoprotein gB, and/or by the deletion of the DNA fragment encoding the transmembrane domain of gB.

15. Vaccine according to Claim 13, wherein it comprises the sequence of the gC gene optimized by a signal sequence, in particular that of the tPA signal of human origin, in place of the sequence of the signal peptide of the glycoprotein gC, and/or by the deletion of the DNA fragment encoding the transmembrane domain of gC.

16. Vaccine according to Claim 13, wherein it comprises the sequence of the gD gene optimized by a signal sequence, in particular that of the tPA signal of human origin, in place of the sequence of the signal peptide of the glycoprotein gD, and/or by the deletion of the DNA fragment encoding the transmembrane domain of gD.

17. Vaccine according to Claim 13, wherein it comprises DMRIE-DOPE, an expression plasmid encoding the BHV-1 gB antigen optimized by the deletion of the fragment of the nucleotide sequence encoding the transmembrane domain and the contiguous C-terminal part, a second expression plasmid encoding the BHV-1 gC antigen optimized by the deletion of the fragment of the nucleotide sequence encoding the transmembrane domain and the contiguous C-terminal part, and a third expression plasmid encoding the BHV-1 gD antigen optimized by the deletion of the fragment of the nucleotide sequence encoding the transmembrane domain and the contiguous C-terminal part.

18. Vaccine according to Claim 1, wherein it comprises a nucleotide sequence of BRSV.

19. Vaccine according to Claim 18, wherein it comprises the sequence of the BRSV F gene optimized by substitution, by a signal sequence, in particular that of the tPA of human origin, of the signal sequence of the F protein of BRSV, and/or by the deletion of the DNA fragment encoding the transmembrane domain of F.

20. Vaccine according to Claim 18, wherein it comprises the sequence of the BRSV G gene optimized by substitution, by a signal sequence, in particular that of the tPA of human origin, of the signal sequence of the G glycoprotein of BRSV, and/or by the deletion of the DNA fragment encoding the transmembrane domain of G.

21. Vaccine according to Claim 18, wherein it comprises DMRIE-DOPE, an expression plasmid encoding the F antigen of BRSV optimized by the insertion of the signal sequence of the human tPA in place of the signal sequence of F, and by the deletion of the fragment of the nucleotide sequence of F encoding the transmembrane domain and the contiguous C-terminal part, and a second expression plasmid encoding the G antigen of BRSV optimized by the insertion of the signal sequence of the human tPA in place of the signal sequence of G, and by the deletion of the fragment of the nucleotide sequence encoding the transmembrane domain of G and the contiguous C-terminal part.

22. Vaccine according to Claim 1, wherein it comprises a nucleotide sequence of BVDV.

23. Vaccine according to Claim 22, wherein it comprises the sequence of the BVDV EO gene optimized by the addition of a signal sequence, in particular that of the tPA of human origin, upstream of the nucleotide sequence encoding the EO protein, and/or by the insertion of an intron, in particular intron II of the rabbit beta-globin gene upstream of the nucleotide sequence encoding EO.

24. Vaccine according to Claim 22, wherein it comprises the sequence of the E2 gene optimized by the addition of a signal sequence, in particular that of the tPA of human origin, upstream of the nucleotide sequence encoding the E2 protein, and/or by the deletion of the DNA fragment encoding the transmembrane domain of E2, and/or by the insertion of an intron, in particular intron II of the rabbit beta-globin gene upstream of the nucleotide sequence encoding E2.

25. Vaccine according to Claim 22, wherein it comprises DMRIE-DOPE, an expression plasmid encoding the EO antigen of BVDV optimized by the insertion of the signal sequence of the human tPA upstream of EO and by the insertion of intron II of

the rabbit beta-globin gene upstream of EO, and a second plasmid encoding the E2 antigen of BVDV optimized by the insertion of the signal sequence of the human tPA upstream of E2, by the deletion of the fragment of the nucleotide sequence encoding the transmembrane domain of E2 and by the insertion of intron II of the rabbit beta-globin gene upstream of E2.

26. Vaccine according to Claim 1, wherein it comprises a nucleotide sequence of bPI-3.

27. Vaccine according to Claim 26, wherein it comprises the sequence of the bPI-3 HN gene optimized by substitution, by a signal sequence, in particular that of the tPA of human origin, of the signal sequence of HN, and/or by the deletion of the DNA fragment encoding the transmembrane domain of HN, and/or by the insertion of an intron, in particular of intron II of the rabbit beta-globin gene upstream of the nucleotide sequence encoding HN.

28. Vaccine according to Claim 26, wherein it comprises the sequence of the bPI-3 F gene optimized by substitution, by a signal sequence, in particular that of the tPA of human origin, of the signal sequence of F, and/or by the deletion of the DNA fragment encoding the transmembrane domain of F, and/or by the insertion of an intron, in particular of intron II of the rabbit beta-globin gene upstream of the nucleotide sequence encoding F.

29. Vaccine according to Claim 26, wherein it comprises DMRIE-DOPE, an expression plasmid encoding the HN antigen of bPI-3 optimized by the insertion of the signal sequence of the human tPA in place of the signal sequence of HN, by the deletion of the fragment of the nucleotide sequence of HN encoding the transmembrane domain and the contiguous C-terminal part and by the insertion of intron II of the rabbit beta-globin gene upstream of HN, and a second expression plasmid encoding the F antigen of bPI-3 optimized

by the insertion of the signal sequence of the human tPA in place of the signal sequence of F, by the deletion of the fragment of the nucleotide sequence encoding the transmembrane domain of F and the contiguous C-terminal part and by the insertion of intron II of the rabbit beta-globin gene upstream of F.

30. Vaccine according to Claim 1, wherein it comprises a nucleotide sequence of PRV.

31. Vaccine according to Claim 30, wherein it comprises the sequence of the gB gene optimized by substitution, by a signal sequence, in particular that of the tPA signal of human origin, of the sequence of the signal peptide of the gB glycoprotein, and/or by the deletion of the DNA fragment encoding the transmembrane domain of gB.

32. Vaccine according to Claim 30, wherein it comprises the sequence of the gC gene optimized by substitution, by a signal sequence, in particular that of the tPA signal of human origin, of the sequence of the signal peptide of the gC glycoprotein, and/or by the deletion of the DNA fragment encoding the transmembrane domain of gC.

33. Vaccine according to Claim 30, wherein it comprises the sequence of the gD gene optimized by substitution, by a signal sequence, in particular that of the tPA signal of human origin, of the sequence of the signal peptide of the gD glycoprotein, and/or by the deletion of the DNA fragment encoding the transmembrane domain of gD.

34. Vaccine according to Claim 30, wherein it comprises DMRIE-DOPE, an expression plasmid encoding the gB antigen of PRV optimized by the deletion of the fragment of the nucleotide sequence encoding the transmembrane domain and of the contiguous C-terminal part, a second expression plasmid encoding the gC antigen of PRV optimized by the deletion of the fragment of the nucleotide sequence encoding the

transmembrane domain and of the contiguous C-terminal part, and a third expression plasmid encoding the gD antigen of PRV optimized by the deletion of the fragment of the nucleotide sequence encoding the transmembrane domain and of the contiguous C-terminal part.

35. Vaccine according to Claim 1, wherein it comprises a nucleotide sequence of PRRSV.

36. Vaccine according to Claim 35, wherein it comprises a nucleotide sequence of the ORF3 gene optimized by substitution, by a signal sequence, in particular that of the tPA signal of human origin, or the sequence of the signal peptide of the protein encoded by ORF3, and/or by the deletion of the DNA fragment encoding the transmembrane domain of ORF3.

37. Vaccine according to Claim 35, wherein it comprises a nucleotide sequence of the ORF5 gene optimized by substitution, by a signal sequence, in particular that of the tPA signal of human origin, or the sequence of the signal peptide of the protein encoded by ORF5, and/or by the deletion of the DNA fragment encoding the transmembrane domain of ORF5.

38. Vaccine according to Claim 35, wherein it comprises a nucleotide sequence of the ORF6 gene optimized by substitution, by a signal sequence, in particular that of the tPA signal of human origin, or the sequence of the signal peptide of the protein encoded by ORF6, and/or by the deletion of the DNA fragment encoding the transmembrane domain of ORF6.

39. Vaccine according to Claim 35, wherein it comprises DMRIE-DOPE, an expression plasmid encoding the ORF3 antigen of PRRSV, a second expression plasmid encoding the ORF5 antigen of PRRSV optimized by substitution of the signal sequence of ORF5 by the human tPA signal peptide sequence and by the deletion of the fragment of the nucleotide sequence encoding the transmembrane domain and the contiguous C-terminal part, and a third expression plasmid encoding the ORF6 antigen of

PRRSV optimized by the substitution of the signal sequence of ORF6 by the human tPA signal peptide sequence and by the deletion of the fragment of the nucleotide sequence encoding the transmembrane domain and the contiguous C-terminal part.

40. Vaccine according to Claim 1, wherein it comprises a nucleotide sequence of SIV.

41. Vaccine according to Claim 40, wherein it comprises a nucleotide sequence of the HA gene optimized by substitution, by a signal sequence, in particular that of the tPA of human origin, of the signal sequence of HA, and/or by the deletion of the DNA fragment encoding the transmembrane domain of HA, and/or by the insertion of an intron, in particular of intron II of the rabbit beta-globin gene upstream of the nucleotide sequence encoding HA.

42. Vaccine according to Claim 40, wherein it comprises a nucleotide sequence of the NA gene optimized by substitution, by a signal sequence, in particular that of the tPA of human origin, of the signal sequence of NA, and/or by the deletion of the DNA fragment encoding the transmembrane domain of NA, and/or by the insertion of an intron, in particular of intron II of the rabbit beta-globin gene upstream of the nucleotide sequence encoding NA.

43. Vaccine according to Claim 40, wherein it comprises DMRIE-DOPE, an expression plasmid encoding the HA antigen of SIV optimized by the insertion of the signal sequence of the human tPA in place of the signal sequence of HA, by the deletion of the fragment of the nucleotide sequence of HA encoding the transmembrane domain and the contiguous C-terminal part, and by the insertion of intron II of the rabbit beta-globin gene upstream of HA, and a second expression plasmid encoding the NA antigen of SIV optimized by the insertion of the signal sequence of the human tPA in place of the signal sequence of NA, by the deletion of the fragment

of the nucleotide sequence encoding the transmembrane domain of NA and the contiguous C-terminal part, and by the insertion of intron II of the rabbit beta-globin gene upstream of NA.

44. Vaccine according to claim 9, wherein it also comprises DOPE.

45. Vaccine according to claim 9, wherein it comprises, in addition, a GM-CSF protein of the animal species considered.

46. Vaccine according to claims 9, wherein it comprises, in addition, an expression vector containing the gene encoding the GM-CSF protein of the animal species considered, under conditions allowing the *in vivo* expression of this sequence.

47. Vaccine according to claim 9, wherein the expression vector is a plasmid.

48. Vaccine according to claim 10, wherein it also comprises DOPE.

49. Vaccine according to claim 10, wherein it comprises, in addition, a GM-CSF protein of the animal species considered.

50. Vaccine according to claim 10, wherein it comprises, in addition, an expression vector containing the gene encoding the GM-CSF protein of the animal species considered, under conditions allowing the *in vivo* expression of this sequence.

51. Vaccine according to claim 10, wherein the expression vector is a plasmid.

52. Vaccine according to claim 11, wherein it also comprises DOPE.

53. Vaccine according to claim 11, wherein it comprises, in addition, a GM-CSF protein of the animal species considered.

54. Vaccine according to claim 11, wherein it comprises, in addition, an expression vector containing the gene encoding

the GM-CSF protein of the animal species considered, under conditions allowing the *in vivo* expression of this sequence.

55. Vaccine according to claim 11, wherein the expression vector is a plasmid.

56. Vaccine according to claim 13, wherein it also comprises DOPE.

57. Vaccine according to claim 13, wherein it comprises, in addition, a GM-CSF protein of the animal species considered.

58. Vaccine according to claim 13, wherein it comprises, in addition, an expression vector containing the gene encoding the GM-CSF protein of the animal species considered, under conditions allowing the *in vivo* expression of this sequence.

59. Vaccine according to claim 13, wherein the expression vector is a plasmid.

60. Vaccine according to claim 18, wherein it also comprises DOPE.

61. Vaccine according to claim 18, wherein it comprises, in addition, a GM-CSF protein of the animal species considered.

62. Vaccine according to claim 18, wherein it comprises, in addition, an expression vector containing the gene encoding the GM-CSF protein of the animal species considered, under conditions allowing the *in vivo* expression of this sequence.

63. Vaccine according to claim 18, wherein the expression vector is a plasmid.

64. Vaccine according to claim 22, wherein it also comprises DOPE.

65. Vaccine according to claim 22, wherein it comprises, in addition, a GM-CSF protein of the animal species considered.

66. Vaccine according to claim 22, wherein it comprises, in addition, an expression vector containing the gene encoding

the GM-CSF protein of the animal species considered, under conditions allowing the *in vivo* expression of this sequence.

67. Vaccine according to claim 22, wherein the expression vector is a plasmid.

68. Vaccine according to claim 26, wherein it also comprises DOPE.

69. Vaccine according to claim 26, wherein it comprises, in addition, a GM-CSF protein of the animal species considered.

70. Vaccine according to claim 26, wherein it comprises, in addition, an expression vector containing the gene encoding the GM-CSF protein of the animal species considered, under conditions allowing the *in vivo* expression of this sequence.

71. Vaccine according to claim 26, wherein the expression vector is a plasmid.

72. Vaccine according to claim 30, wherein it also comprises DOPE.

73. Vaccine according to claim 30, wherein it comprises, in addition, a GM-CSF protein of the animal species considered.

74. Vaccine according to claim 30, wherein it comprises, in addition, an expression vector containing the gene encoding the GM-CSF protein of the animal species considered, under conditions allowing the *in vivo* expression of this sequence.

75. Vaccine according to claim 30, wherein the expression vector is a plasmid.

76. Vaccine according to claim 35, wherein it also comprises DOPE.

77. Vaccine according to claim 35, wherein it comprises, in addition, a GM-CSF protein of the animal species considered.

78. Vaccine according to claim 35, wherein it comprises, in addition, an expression vector containing the gene encoding

the GM-CSF protein of the animal species considered, under conditions allowing the *in vivo* expression of this sequence.

79. Vaccine according to claim 35, wherein the expression vector is a plasmid.

80. Vaccine according to claim 40, wherein it also comprises DOPE.

81. Vaccine according to claim 40, wherein it comprises, in addition, a GM-CSF protein of the animal species considered.

82. Vaccine according to claim 40, wherein it comprises, in addition, an expression vector containing the gene encoding the GM-CSF protein of the animal species considered, under conditions allowing the *in vivo* expression of this sequence.

83. Vaccine according to claim 40, wherein the expression vector is a plasmid.